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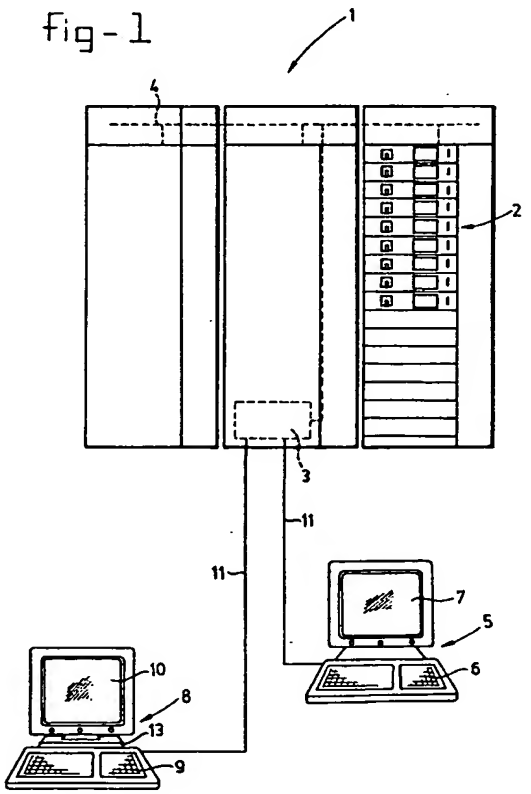
(54) Electronic switching-on apparatus and a switching-on method.

(57) Apparatus for automatically switching on again one or more motors, in which for each motor or for each set of motors an electromagnetic switch (40) fed by the mains voltage operates switching means which are placed between the motor windings and the mains voltage, which apparatus further at least comprises, for each electromagnetic switch, a start control unit (2) which is connected to the respective electromagnetic switch in order to supply it with switching-on or switching-off commands, wherein the apparatus further comprises at least one mains monitor (46) which monitors the state of the mains and provides indication signals in accordance with the mains state via an output to the start control units (2), and a central control unit (3) which is able to communicate, via first connection means (4), with, inter alia, the start control units (2) and is able to communicate, via other connection means (11, 12), with control units (5, 8) operated by a user.

fig-1



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The present invention relates to an apparatus for automatically switching on again at least one load comprising switching means which are connected between the load and the mains voltage, at least one mains monitor which monitors the state of the mains and provide indication signals in accordance with the mains state to at least one start control unit, which may supply switching-on or switching-off commands to the switching means.

Such an apparatus is disclosed in US-A-4.987.513 and is arranged to solve the problem of a "cold start" of electrical loads after a failure of the mains voltage. Such a "cold start" is characterised by a sudden peak power consumption, because many electrical loads show rather large peak currents during a restart phase. By applying the measures mentioned above it is possible to delay the restart of different loads by a different amount of time in order to stagger the various restarts and to prevent an overload of the mains. However, in the apparatus as known predetermined delay times in order to have a reliable safety margin are used. Safety margins of this type result in time being wasted.

The problem is, in particular, present in the field of remote control of "motor control centres". Said "motor control centres" are, for instance, used in process engineering for controlling the process, measuring process variables and signalling process states, as well as for protecting the motors used in the process. The "motor control centres" usually comprise modules, often in the form of drawers which can be removed from a cabinet, each module being linked to one motor. Each of these modules contains the equipment necessary for controlling the motor linked to the module and protecting it electrically, and can comprise one or more panels. EP-A-0,163,572 per se discloses the remote control of "motor control centres" in the context of further automation thereof.

FR-A-2.094.994 describes an apparatus arranged to start various electrical machines connected to a mains, comprising a detector detecting a possible overload of the mains and supplying an enable signal, if the mains voltage is restored. Every machine may only be restarted by control means upon receipt of a specific code related to the machine concerned and supplied by an operator. However, although not all machines will request for a restart after a mains failure, the control means uses a predetermined restart table which comprises all machines connected. During the restart phase the control means "runs" through the entire table with a predetermined speed without avoiding the machines not having requested a restart. Therefore, time is waisted during the restart phase.

It is therefore an object of the present invention to provide an apparatus and a method for automatically switching loads on again, which shorten as far as possible the time required for the loads to be switched on again.

This object is obtained by an apparatus as defined above and that is characterised in that the apparatus further comprises a central control unit which is able to communicate, via first connection means, with, inter alia, various start control units, which is able to communicate, via other connection means, with control units operated by a user, and which is arranged to compile a reclosing table in accordance with predefined criteria after opening of the switching means, caused by a mains failure, and to transmit switching-on commands in accordance with the reclosing table to those start control units, which have send a reclose request signal to the central control unit.

In a preferred embodiment the apparatus is characterised in that each load comprises one or more motors and an electromagnetic switch is connected between each switching means and each start control unit, the electromagnetic switch receiving its power from the mains itself, being controlled by the start control unit and operating the switching means.

The invention further relates to an apparatus in which the control units comprise local control units and remote control units.

The invention also relates to a method performed by computer software implemented on one of the apparatuses defined above, which performs at least the following steps:

a. detection of opening of one or more switching means;

b. detecting whether said opening is the result of a mains fault;

c. after a mains fault, testing whether the mains voltage has been restored, i.e. whether it has risen above a predefined threshold value (Uth2);

d. upon restoration of the mains voltage, detecting the duration of the mains fault;

e1. upon restoration of the mains voltage within a predefined time t1, supplying commands for immediate closing of the opened switching means, or alternatively

e2. upon restoration of the mains voltage after a predefined time t1, compiling a reclosing table in accordance with predefined criteria and for only those start control units that have sent a request for reclosure of their respective switching means;

f. supplying the closing commands for the switching means in the sequence of the reclosing table, each subsequent reclosing command being enabled if the mains monitor supplies an indication signal which specifies that the

mains voltage has risen above the predefined value (Uth2).

In one embodiment of the apparatus described in US-A-4.987.513 mentioned above the switching means will not be opened if the mains failure does not last longer than a predetermined amount of time. So, in that case loads will not be disconnected from the mains. However, in the present invention, upon a mains failure all closed switching means will automatically be opened and will be reclosed simultaneously, when the mains failure does not last longer than a predetermined amount of time.

In a preferred embodiment of the method according to the invention, in step c the time span is also measured which elapses from the moment the mains fault occurred and, after a predefined time span t4 has been exceeded, the reclosing loop is interrupted.

In a further preferred embodiment of the method, t4 can be set individually for each load or set of loads.

In a further preferred embodiment of the method, the predefined threshold value (Uth2) is equal to approximately 0.9 Un, Un being the nominal mains voltage.

In a further preferred embodiment of the method, the predefined time t1 is at most 0,5 sec.

In a further preferred embodiment of the method, t1 is approximately 0.2 sec.

In a further preferred embodiment of the method, the loads are motors and the criteria for compiling the reclosing table are derived from characteristics concerning the motors and/or the state of a process controlled by the motors at the time of the mains fault.

In a further preferred embodiment of the apparatus according to the invention, in which a computer program according to the above-mentioned method has been implemented, the method steps a to e1 inclusive are implemented in computer programs which are identically located in memory space of all the start control units and the method steps e2 and f are implemented in computer software which is located in memory space of the central control unit, the software in the respective start control units communicating via the first connection means with the software in the central control unit.

Applying the measures according to the invention results in each motor or set of motors being switched on again in as short a time as possible, while the necessary safety margins are being observed.

The invention will be explained in more detail with reference to a few drawings which are intended solely for illustrative purposes and not as a limitation of the concept of the invention, and in which

Figure 1 shows a remote-controlled "motor control centre";

Figure 2 shows a view of a central control unit;

Figure 3 shows a view of a start control unit;

Figure 4 shows an example of a three-phase supply with an electromagnetic switch used for a motor;

Figure 5 shows a flowchart of the method according to the invention;

Figure 6 shows an example of the starting current of a motor.

An example of a remote-controlled "motor control centre" 1 is shown in Figure 1. The "motor control centre" 1 shown there comprises at least one or more start control units 2 (SCU), each of which control one motor or a set of motors, and also ensure the protection thereof. Each of the SCUs 2 is connected to a first data bus 4 for receiving and transmitting information. The "motor control centre" 1 further comprises a central control unit 3 (CU) which is likewise connected to the first data bus 4. The central control unit 3 is connected, via a second data bus 11 to a local control unit 5 (LCU) which, for example, comprises a keyboard 6 and a screen 7. With the aid of the keyboard 6 and the screen 7, a local user can give commands to the central control unit 3, for example to switch off a certain motor. In addition, the central control unit 3 can provide information to the local control unit 5 via the second data bus 11. It will be evident that, although only one local control unit 5 is drawn, various local control units can be used.

Via the second data bus 11, the central control unit 3 is also connected to one or more remote control units 8 (DCS) which may each comprise a keyboard 9, a screen 10 and means for storing and processing data 13. Other configurations are of course conceivable.

Figure 2 shows a view of possible functional units used in the central control unit 3. The central control unit 3 is connected, via a central data processing card 14, to the second data bus 11 which leads to the remote control units 8 and the local control units 5 (Figure 1). The central control unit 3 further comprises one or more start control communication units 15, 16 which are each connected to the first data bus 4 and, via a data line 20, to one or more analog mains voltage measuring cards 17, 18. Internal communication between the central data processing card 14 and the start control communication units 15, 16 within the central control unit 3 takes place via a VME bus 19 (VME = Versa Module Eurocard).

The central data processing card 14 deals with the following functions:

- storage of data from the entire reclosing system, as shown in Figure 1;
- communication via data bus 11;
- "master" module for the VME system;
- delayed switching-on again of motors after a prolonged mains failure. The motors requiring switching-on again report via the first data bus 4, the start control communication units 15, 16 and the VME bus 19.

Each of the two identical start control communication units 15, 16 is intended to perform the following functions:

- interface with the VME bus 19;
- communication with the start control units 2 via the first data bus 4;
- signalling the state of an individual mains based on information obtained via data line 20, and reporting this to the start control units 2.

The mains voltage measuring cards 17, 18 are identical and designed for the following functions:

- measuring the state of an individual mains by means of filters not specified in any detail;
- reporting said state to the respective start control communication units 15, 16 via data line 20.

If both the start control communication units 15, 16 are used as well as both of the mains voltage measuring cards 17, 18, the central control unit can monitor two separate mains each of which supply their own motors or sets of motors.

Figure 3 shows a possible embodiment of one of the start control units 2 used. Each start control unit comprises a microprocessor 21 which can directly receive or transmit digital information via data lines 22 and 23, respectively and can directly receive or transmit analog data via data lines 24 and 25, respectively. The microprocessor 21 is further connected to an internal data bus 26 which in turn is connected to a programmable read-only memory (PROM) 27, a random-access memory (RAM) 28, an electrically erasable programmable read-only memory (EEPROM) 29 and the first data base 4 via interface means 30, 31.

The programmable read-only memory 27 comprises predefined computer programs. The random-access memory 28 can be used to store motor-setting data and current motor data which may, if required, be adjusted by a user. The electrically erasable programmable read-only memory 29 is used to store predefined motor-setting data.

Figure 4 shows an example of an electromagnetic switch 40 connected to a three-phase mains. The three incoming phases are denoted by 32, 33 and 34, respectively, while the three outgoing phases are indicated by 41, 42 and 43, respectively. The three phase connections are switched with the aid of switches 36, 37 and 38, respectively, all three of which are simultaneously opened or closed, which is effected by a drive mechanism 45 attached to all the three switches 36, 37, 38. The drive mechanism 45 is displaced with the aid of the electromagnetic switch 40 which receives its supply current from one of the phases of the mains, for example 34, via a switch 39 which is likewise attached to the drive mechanism 45. The electromagnetic switch 40 is further connected, via a line 44, to the neutral conductor 35 and has an input X for receiving an actuation signal. Finally, a mains monitor 46 is linked to phase line 34, which monitors the state of the mains and can report the information with regard thereto to all the start control units 2 via an output 47. The mains monitor 46 comprises the mains voltage measuring cards 17, 18 shown in Figure 2, and the output 47 thereof is thus connected to the connection line 20 of Figure 2. The latter is effected within a time span of 10 ms. It will be evident to those skilled in the art that variations on the circuit of Figure 4 are possible without affecting the essence thereof. Thus, the mains monitor 46 can be connected to more than one phase, and the electromagnetic switch can receive an actuating current in some other manner.

As long as the mains voltage satisfies predefined conditions, the electromagnetic switch 40 will maintain the switches 36-39 in the conducting state, if the corresponding command has been issued via either one of the local control units 5 or one of the remote control units 8, or as a result of a command from the central control unit 3.

If the mains voltage drops below a certain threshold value Uth1 over a certain time (after at most a few hundred ms, depending on the size of the electromagnetic switch 40), the current supplied to the electromagnetic switch 40 via switch 39 will have become too low to keep the switch 40 in the actuated state, and the electromagnetic switch 40 drops out. Thereupon, all the switches 36-39 are brought into the non-conducting state. Because switch 39 likewise does not conduct, the electromagnetic switch 40 can no longer be actuated without external assistance. Said threshold value Uth1 in the preferred embodiment is equal to ± 0.65 Un (Un is the nominal mains voltage). Actuation takes place, for example, via connection X (Figure 4) with the aid of an auxiliary contact, controlled by the corresponding start control unit 2, which is not shown in the figure but is known to those skilled in the art. Via detectors and lines (not shown), each start control unit 2 is able to interrogate the state of the associated electromagnetic switch 40. This state can then be changed as required.

Figure 5 shows a flowchart of the steps which are implemented in computer software of the start control units 2 and the central control unit 3 and

which ensure reclosing of the electromagnetic switches 40 after they have dropped out as a result of a fault in the mains voltage. Steps 50-56 and 60 describe actions which take place in each of the start control units 2, while steps 57, 58 and 59 relate to software implemented in the central control unit.

In step 50, the program tests whether the electromagnetic switch 40 in question has dropped out. The information thereon is received by the start control unit 2 from a detector (not shown) which measures the current through the auxiliary contact of the electromagnetic switch 40. As soon as that is the case, the program continues with step 51 in which it is ascertained whether or not the drop-out is the result of a mains fault. This is done, for example, by establishing that the drop-out of the electromagnetic switch 40 coincides with a fault in the mains (U < Uth1) which is detected by means of the mains monitor 46. If the drop-out of the electromagnetic switch 40 is not due to a mains fault, no reclosing takes place, and instead the program returns to step 50. If the drop-out is due to a mains fault, the program continues the reclosing procedure with step 52. The time the program requires to run through the steps 50, 51 is the reaction time of the system which must be very short, for example less than 20 ms.

In step 52, the program tests whether the mains voltage is above a predefined threshold value Uth2. Uth2 is usually set to 0.9 Un. As long as this requirement is not yet met, the program remains in a wait loop in which it tests, in step 53, whether the time elapsed since drop-out of the electromagnetic switch does not exceed the predefined threshold value t4. If that is the case, an alarm signal can be generated and the program returns to the start of the reclosing loop in step 50. It should be noted, that measuring of the mains voltage(s) takes place centrally with the aid of the mains voltage measuring card(s) 17 (and 18), while establishing that an electromagnetic switch has dropped out takes place decentrally.

As soon as the mains voltage has risen above the threshold value Uth2, which means that the mains voltage is once more sufficient for reclosing the electromagnetic switches, the program in step 54 tests for how long the mains fault in question has lasted. If the mains fault has lasted longer than a certain time span t1, which is at most 0.5 sec, all the motors which have failed must be started up again slowly and in a defined sequence, as will be explained below. If, however, the mains fault has been shorter than the time span t1, it can be assumed that the motors in question which were active prior to the fault, still have a certain speed and will be able to be actuated immediately without any safety problems. In this latter case, the program continues with step 55 in which this so-called " fast restart" takes place.

If the mains fault has lasted for longer than t1, not all the electromagnetic switches which have dropped out can be closed simultaneously without the risk of overloading the mains. This is because, if a motor at standstill is switched on, a current flows through the motor windings which is shown diagrammatically in Figure 6. After switching on, the motor, over a short period, draws a large peak current, before the current eventually reaches its nominal value. If, therefore, too many motors are switched on simultaneously, the mains has to supply too much current and the mains voltage may collapse, with the result that the electromagnetic switches which have just been closed drop out again. After a mains failure which has lasted for longer than t1, the program therefore continues with steps 56-60 which together effect the so-called "slow start".

In step 56, the start control unit 2 in question asks the central control unit 3 for permission to switch on its motors or set of motors. During steps 57, 58 and 59, which relate to the software in the central control unit 3, the program in the start control unit 2 waits until the central control unit 3 has granted this permission. In step 57, the central control unit 3 collects all the reclosing requests reported by the start control units. Because some of the electromagnetic switches may have been opened deliberately, not all the programs of the various start control units need have reached step 56. While the central control unit collects the requests from all the start control units, the program in the central control unit is already starting on step 58, in which it compiles, based on predefined criteria, a reclosing table. This table contains the sequence in which the electromagnetic switches in question can best be closed again. The ideal sequence preferably depends on two criteria, namely the process stage at the time the mains fault has occurred, and the type of the motors which have to be switched on at that time. It may be the case, namely, that some motor types are preferably to be switched on before others.

Preferably, the program in the central control unit 3, even while a reclosing table according to the above-mentioned criteria is being compiled, continues with step 59 in which the central control unit issues consecutive start commands to the various start control units in accordance with the above-mentioned table. In this process, the mains monitor 46 also plays an important part. The latter, namely, monitors the state of the mains and, each time the mains voltage rises above a predefined value of preferably 0.9 Un, emits an indication signal which states that the next reclosing may take place. In Figure 6 this takes place at point of time t2. Fur-

thermore, in Figure 6, t3 indicates diagrammatically the point in time at which it is decided in conventional, prior art devices, that the next motor or set of motors may be switched on, t3 in the conventional devices having a fixed predefined value which has a certain safety margin, so that it is never possible for the next motor or set of motors to be switched on too soon. Because the time-wise separation between steps 57, 58 and 59 is not strictly adhered to, but where possible the central control unit 3 carries out the activities of steps 57, 58 and 59 in parallel, time is saved. Furthermore, with regard to the prior art, time is saved because only those motors and sets of motors are placed in the table which have given an indication that they should be switched on again. In the prior art, by contrast, an attempt is made, using a fixed reclosing table, to start up again all the motors, including those which had been switched off deliberately, resulting in an unnecessary waste of computer time.

As soon as the central unit of the mains motor 46 receives the indication signal which indicates that the mains voltage has risen above a certain value (90% Un, Uth2), the central control unit 3 supplies a start command to the start control unit 2 whose turn it is according to the table. This takes place, in the diagram of Figure 5, in step 59. If all the start commands have been issued according to the table sequence, the program located in the central control unit is ready. The program present in each start control unit finishes with step 60, in which the electromagnetic switch is closed again, whereupon the program returns to its start state in step 50.

In addition to the steps shown in the chart of Figure 5, it is preferably also provided that, if one or more of the electromagnetic switches are opened during a reclosing loop, the reclosing loop is interrupted and returns to its start position in step 50. Opening of an electromagnetic switch 40 is effected, for example, by means of a command which is received by the start control unit 2 via the first connection means 4. If the start control unit 2 receives such a command, its reclosing loop will be interrupted. A reclosing loop can also be interrupted deliberately via a suitable command to the start control unit 2 via the first connection means 4. Such a command can be issued at any time via the local control unit 5 or the remote control unit 8.

To summarise, the reclosing loop according to the invention has the following characteristics:

a. no reclosing takes place of those electromagnetic switches which have been opened deliberately;

b. reclosing takes place if the mains voltage once more rises above a predefined threshold value Uth2, Uth2 in the preferred embodiment being approximately 0.9 Un;

c. if a mains fault causes one or more electromagnetic switches to drop out, but lasts for less long than a preset time t1, reclosing takes place directly ("fast restart"); t1 is at most 0.5 sec and preferably ± 0.2 sec, and is the time at which it can be assumed that the motors have not yet come to a standstill and do not demand a large starting current;

d. if a mains fault lasts for longer than t1, switching-on takes place in a staggered manner in such a way that different motors do not simultaneously require high starting currents leading to a collapse of the mains voltage ("slow start");

e. if the mains voltage remains absent for longer than a predefined time, which can be set for each motor or set of motors, the reclosing procedure is interrupted;

f. if during a reclosing procedure one or more electromagnetic switches are opened, the reclosing procedure for the motor or set of motors in question is interrupted.

It will be evident to those skilled in the art that modifications can be applied to the preferred embodiments outlined above without transcending the scope of the concept of the invention which is defined solely by the appended claims. By way of example, the concept of the invention is not limited to electrical motors; it is applicable to the switching-on of any kind of electrical loads having starting current characteristics as diagrammatically shown in Figure 6, i.e. starting current characteristics showing starting peaks being significantly larger than the after-start current flows

Claims

1. Apparatus for automatically switching on again at least one load comprising switching means (36-38) which are connected between the load and the mains voltage, at least one mains monitor (46) which monitors the state of the mains and provide indication signals in accordance with the mains state to at least one start control unit (2), which may supply switching-on or switching-off commands to the switching means (36-38) characterised in that the apparatus further comprises a central control unit (3) which is able to communicate, via first connection means (4), with, inter alia, various start control units (2), which is able to communicate, via other connection means (11), with control units (5, 8) operated by a user, and which is arranged to compile a reclosing table in accordance with predefined criteria after opening of the switching means (36-38), caused by a mains failure, and to transmit switch-

ing-on commands in accordance with the reclosing table to those start control units (2), which have send a reclose request signal to the central control unit (3).

2. Apparatus according to claim 1 characterised in that each load comprises one or more motors and an electromagnetic switch (40) is connected between each switching means (36-38) and each start control unit (2), the electromagnetic switch (40) receiving its power from the mains itself, being controlled by the start control unit (2) and operating the switching means (36-38).

3. Apparatus according to Claim 1 or 2, characterized in that the control units (5, 8) comprise local control units (5) and remote control units (8).

4. Method performed by computer software implemented on the apparatus according to one of the preceding claims, characterized in that this carries out at least the following steps:
   a. detection of opening of one or more switching means (36-38);
   b. detecting whether said opening is the result of a mains fault;
   c. after a mains fault, testing whether the mains voltage has been restored, i.e. whether it has risen above a predefined threshold value (Uth2);
   d. upon restoration of the mains voltage, detecting the duration of the mains fault;
   e1. upon restoration of the mains voltage within a predefined time t1, supplying commands for immediate closing of the opened switching means (36-38), or alternatively
   e2. upon restoration of the mains voltage after a predefined time t1, compiling a reclosing table in accordance with predefined criteria and for only those start control units (2) that have sent a request for reclosure of their respective switching means (36-38);
   f. supplying the closing commands for the switching means (36-38) in the sequence of the reclosing table, each subsequent reclosing command being enabled if the mains monitor (46) supplies an indication signal which specifies that the mains voltage has risen above the predefined value (Uth2).

5. Method according to Claim 4, characterized in that in step c the time span is also measured which elapses from the moment the mains fault occurred and in that, after a predefined time span t4 has been exceeded, the reclosing loop is interrupted.

6. Method according to Claim 4 or 5, characterized in that steps e2 and f are performed in parallel, at least in part.

7. Method according to any one of Claims 4 to 6 inclusive, characterized in that t4 can be set individually for each load or set of loads.

8. Method according to any one of Claims 4 to 7 inclusive, characterized in that the predefined threshold value (Uth2) is equal to approximately 0.9 Un, Un being the nominal mains voltage.

9. Method according to any one of Claims 4 to 8 inclusive, characterized in that the predefined time t1 is at most 0.5 sec.

10. Method according to Claim 9, characterised in that t1 is approximately 0.2 sec.

11. Method according to any one of the preceding claims, characterized in that the loads are motors and the criteria for compiling the reclosing table are derived from characteristics concerning the motors and/or the state of a process controlled by the motors at the time of the mains fault.

12. Apparatus according to Claim 1, 2 or 3, in which the method according to any one of Claims 3 to 10 inclusive is implemented, characterized in that the method steps a to e1 inclusive are implemented in computer programs which are identically located in memory space of all the start control units (2) and that the method steps e2 and f are implemented in computer software which is located in memory space of the central control unit (3), the software in the respective start control units (2) communicating via the first connection means (4) with the software in the central control unit (3).

Fig - 1

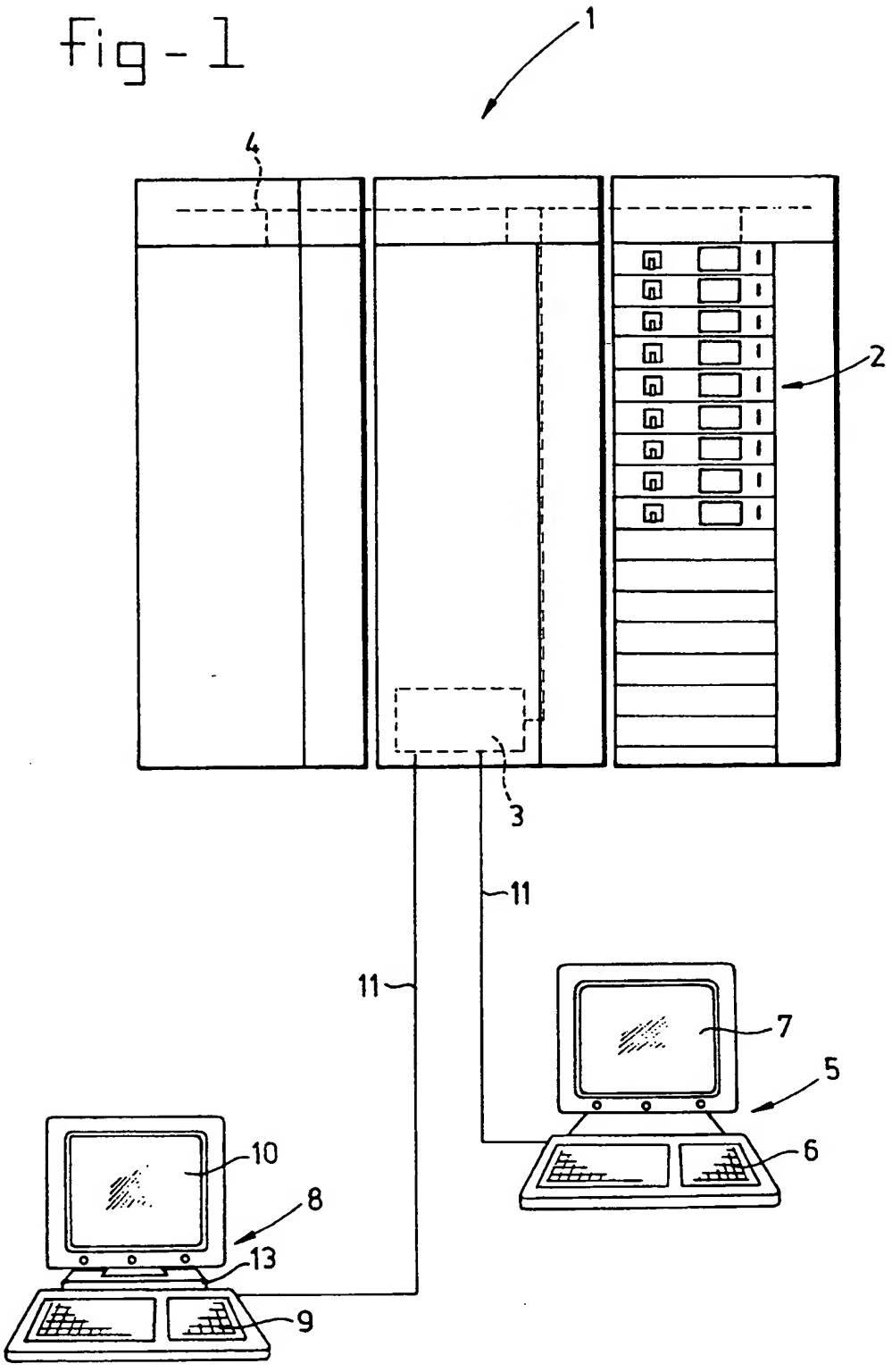


Fig-2

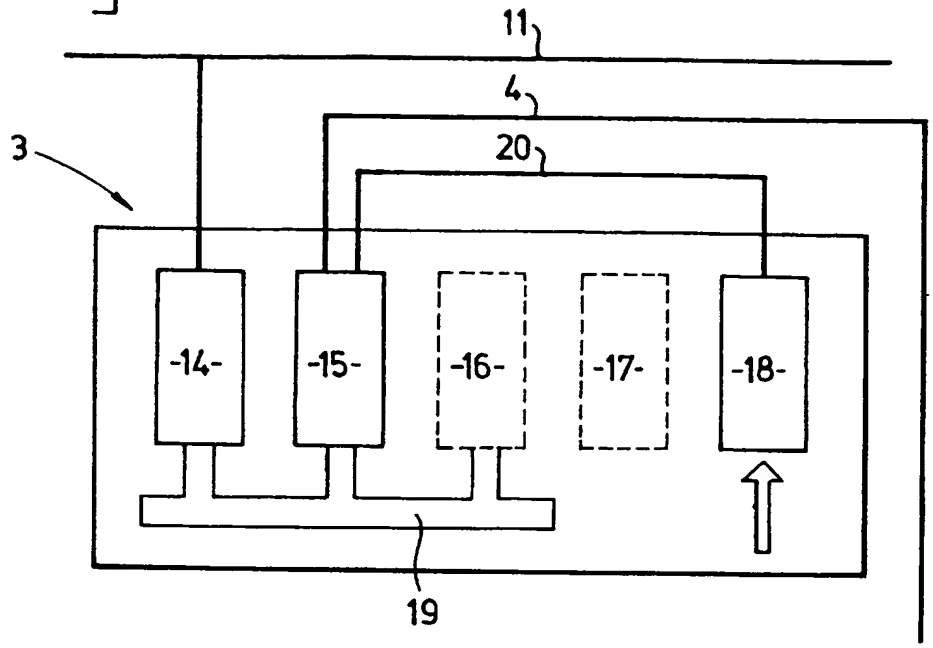


Fig-3

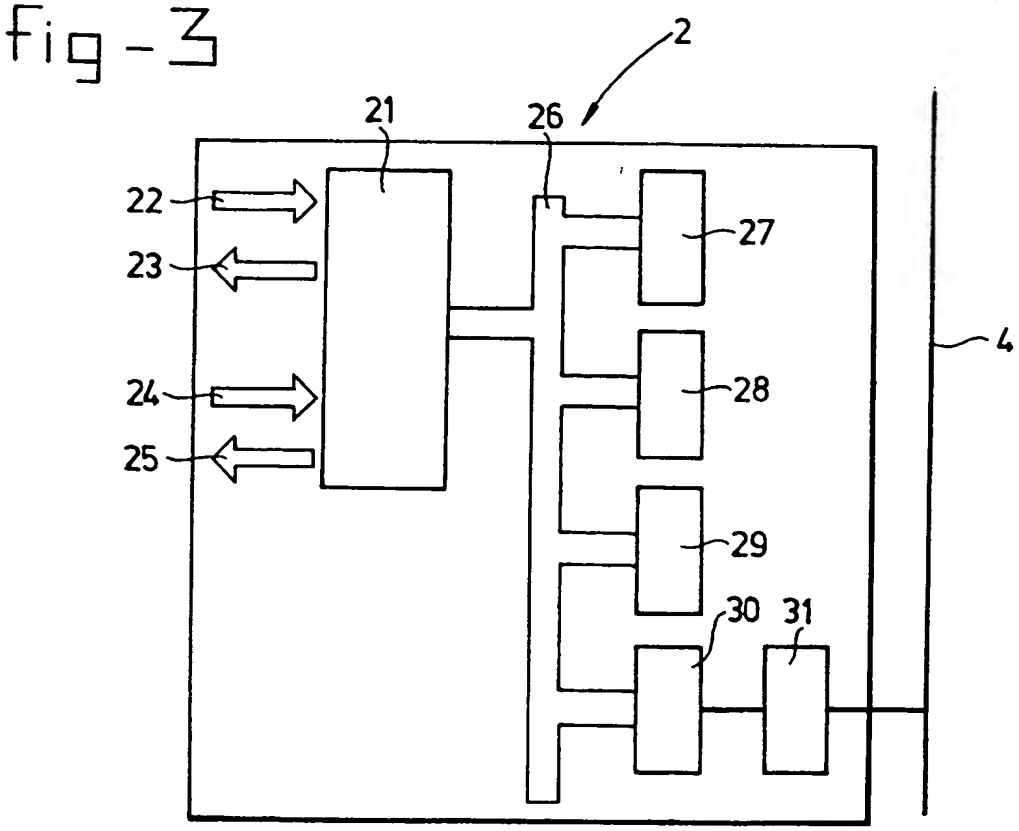


Fig-4

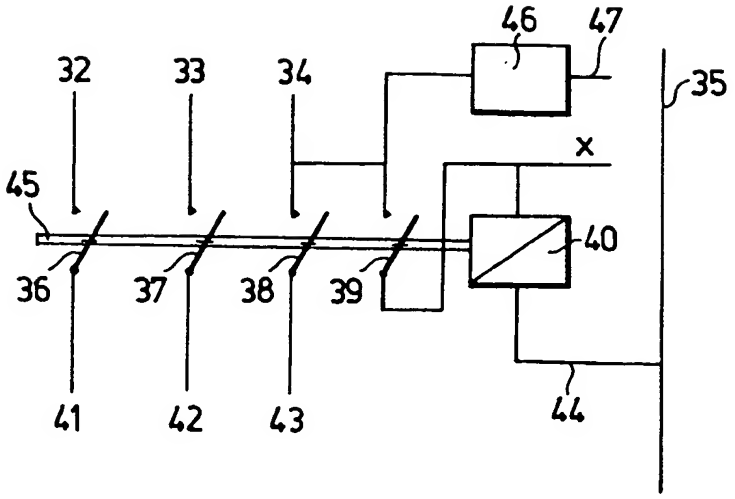
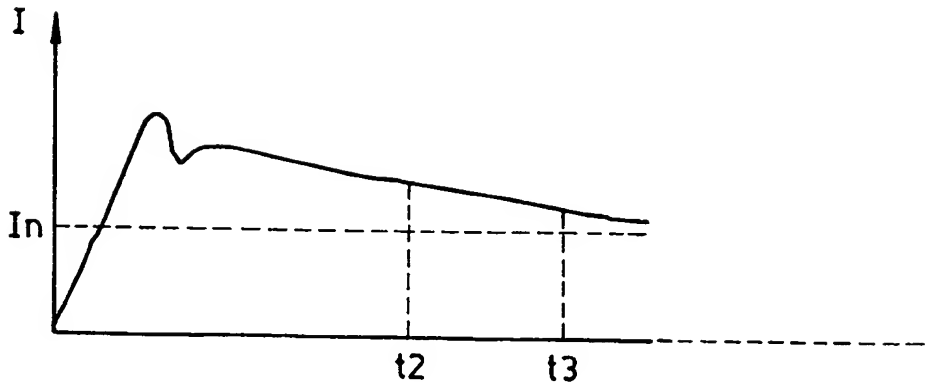


Fig-6



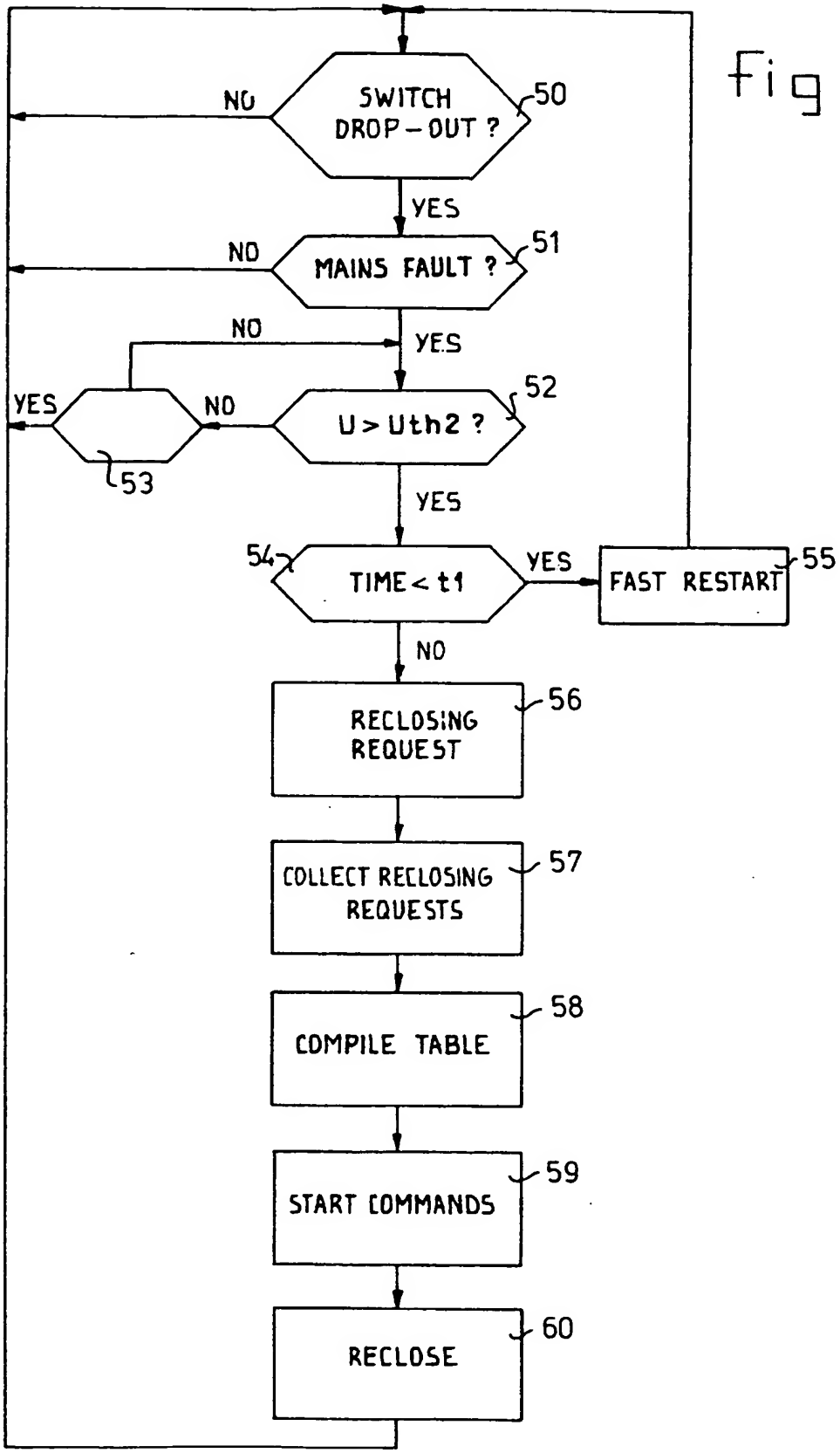

SWITCH DROP – OUT ?
50
NO
YES
MAINS FAULT ?
51
NO
YES
U > Uth2 ?
52
NO
YES
53
TIME < t1
54
YES
FAST RESTART
55
NO
RECLOSING REQUEST
56
COLLECT RECLOSING REQUESTS
57
COMPILE TABLE
58
START COMMANDS
59
RECLOSE
60

Fig-5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 20 2036

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y,D	US-A-4 987 513 (E. SHELLEY) * abstract * * column 1, line 21 - line 43 * * column 4, line 51 - column 5, line 41; figure 4 *	4	H02J3/14 H02H11/00
A		1	

Y,D	FR-A-2 094 994 (J. CAMION ET AL.) * page 1, line 19 - page 2, line 37; figures 1-4 *	4	
A		1	

Y	US-A-4 774 441 (S. TOYOMASU ET AL.) * column 2, line 13 - line 42; figure 1 *	4	

A,D	EP-A-0 163 572 (SPIE BATIGNOLLES) * abstract *	1,4	

A	US-A-3 317 802 (H. ODGEN) * column 1, line 53 - line 64 * * column 3, line 25 - column 4, line 75 *	1,4	TECHNICAL FIELDS SEARCHED (Int.Cl.5)

A	US-A-3 937 978 (C. OWENBY JR.) * column 2, line 3 - line 15 * * column 4, line 34 - line 46 * * column 7, line 10 - line 44; figures 1,3 *	1,4	H02H H02P H02J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 October 1993	HELOT, H

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